Port of Corpus Christi, Texas, After Action Report

Introduction.

A Port Risk Assessment was conducted for the port of Corpus Christi, Texas 30 - 31 August 1999. This report will provide the following information:

- Brief description of the process used for the assessment;
- List of participants;
- Numerical results from the Analytical Hierarchy Process (AHP); and
- Summary of risks and mitigations discussion.

Follow-on strategies to develop and implement unmitigated risks will be the subject of a separate report.

Process.

The risk assessment process is a disciplined approach to obtaining expert judgements on the level of waterway risk. The process also addresses the relative merit of specific types of Vessel Traffic Management (VTM) improvements for reducing risk in the port. Based on the Analytic Hierarchy Process (AHP)[1], the port risk assessment process involves convening a select group of expert/stakeholders in each port and conducting structured workshops to evaluate waterway risk factors and the effectiveness of various VTM improvements. The process requires the participation of local Coast Guard officials before and throughout the workshops. Identification of local risk factors/drivers and selecting appropriate risk mitigation measures is thus accomplished by a joint effort involving experts and stakeholders, including both waterway users and the agencies/entities responsible for implementing selected risk mitigation measures.

This methodology hinges on the development of a generic model of vessel casualty risk in a port. Since risk is defined as the product of the probability of a casualty and its consequences, the model includes variables associated with both the causes and the effects of vessel casualties. The model uses expert opinion to weight the relative contribution of each variable to the overall port risk. The experts are then asked to establish scales to measure each variable. Once the parameters have been established for each risk-inducing factor, the port's risk is estimated by inputting values for the variables specific to that port into the risk model. The model also produces an index of relative merit for five VTM levels as perceived by the local experts assembled for each port.

[1] Developed by Dr Thomas L. Saaty, et al to structure complex decision making, to provide scaled measurements, and to synthesize many factors having different dimensions.

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Participants.

The following is a list of stakeholders/experts that participated in the process:

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Numerical Results.

Book 1 - Factors *(Generic Weights sum to 100))*

Fleet Composition	Traffic Conditions	Navigational Conditions	Waterway Configuration	Short-term Consequences	Long-term Consequences
11.9	8.6	26.4	19.6	14.4	19.1

Analysis:
The participants contributed the above scores to the National Model. They determined that the navigational conditions and waterway configurations are the largest drivers of risk.

Book 2 - *Risk Subfactors (Generic Weights)*

Fleet Composition	Traffic Conditions	Navigational Conditions	Waterway Configuration	Short-term Consequences	Long-term Consequences
11.9	8.6	26.4	19.6	14.4	19.1
% High Risk Deep Draft	Volume Deep Draft	Wind Conditions	Visibility Obstructions	Volume of Passengers	Economic Impacts
6.6	2.3	5.4	4.0	2.6	4.6
% High Risk Shallow Draft	Volume Shallow Draft	Visibility Conditions	Passing Arrangements	Volume of Petroleum	Environmental Impacts
5.3	1.7	1.9	5.1	3.3	8.7
	Vol. Fishing & Pleasure Craft	Currents, Tides, Rivers	Channel and Bottom	Volume of Chemicals	Health & Safety Impacts
	2.2	6.4	9.0	8.5	5.9
	Traffic Density	Ice Conditions	Waterway Complexity		
	2.4	2.7	1.6		

Analysis:
The participants contributed the above results to the national model. Subfactors contributing the most to overall risk under each of the six major factors were:

- For the fleet composition factor, high-risk deep draft and high risk shallow draft vessels contribute about the same amount.
- For traffic conditions, the volume of deep draft, the volume of fishing and pleasure craft, and traffic density contribute about the same amount.
- For navigational conditions, visibility conditions contribute the most.
- For waterway configuration, channel and bottom characteristics contribute the most.
- For short-term consequences, the volume of chemicals contributes the most.
- For long term consequences, environmental impact contributes the most.

Book 3 *Subfactor Scales - Condition List (Generic)*

	Scale Value
Wind Conditions	
a. Severe winds < 2 days / month	1.0
b. Severe winds occur in brief periods	2.3
c. Severe winds are frequent & anticipated	5.0
d. Severe winds occur without warning	9.0
Visibility Conditions	
a. Poor visibility < 2 days/month	1.0
b. Poor visibility occurs in brief periods	2.5
c. Poor visibility is frequent & anticipated	5.4
d. Poor visibility occurs without warning	9.0
Current, Tide or River Conditions	
a. Tides & currents are negligible	1.0
b. Currents run parallel to the channel	2.3
c. Transits are timed closely with tide	5.2
d. Currents cross channel/turns difficult	9.0
Ice Conditions	
a. Ice never forms	1.0
b. Some ice forms-icebreaking is rare	2.0
c. Icebreakers keep channel open	5.2
d. Vessels need icebreaker escorts	9.0
Visibility Obstructions	
a. No blind turns or intersections	1.0
b. Good geographic visibility-intersections	2.0
c. Visibility obscured, good communications	5.1
d. Distances & communications limited	9.0
Passing Arrangements	
a. Meetings & overtakings are easy	1.0
b. Passing arrangements needed-ample room	2.2
c. Meetings & overtakings in specific areas	5.8
d. Movements restricted to one-way traffic	9.0
Channel and Bottom	
a. Deep water or no channel necessary	1.0
b. Soft bottom, no obstructions	2.2
c. Mud, sand and rock outside channel	5.1
d. Hard or rocky bottom at channel edges	9.0
Waterway Complexity	
a. Straight run with NO crossing traffic	1.0
b. Multiple turns > 15 degrees-NO crossing	2.6
c. Converging - NO crossing traffic	4.8
d. Converging WITH crossing traffic	9.0

Passenger Volume

a. Industrial, little recreational boating	1.0
b. Recreational boating and fishing	3.1
c. Cruise & excursion vessels-ferries	5.6
d. Extensive network of ferries, excursions	9.0

Petroleum Volume

a. Little or no petroleum cargoes	1.0
b. Petroleum for local heating & use	2.1
c. Petroleum for transshipment inland	4.9
d. High volume petroleum & LNG/LPG	9.0

Chemical Volume

a. Little or no hazardous chemicals	1.0
b. Some hazardous chemical cargo	2.1
c. Hazardous chemicals arrive daily	5.0
d. High volume of hazardous chemicals	9.0

Economic Impacts

a. Vulnerable population is small	1.0
b. Vulnerable population is large	3.1
c. Vulnerable, dependent & small	5.2
d. Vulnerable, dependent & Large	9.0

Environmental Impacts

a. Minimal environmental sensitivity	1.0
b. Sensitive, wetlands, VULNERABLE	3.0
c. Sensitive, wetlands, ENDANGERED	5.8
d. ENDANGERED species, fisheries	9.0

Safety and Health Impacts

a. Small population around port	1.0
b. Medium - large population around port	2.3
c. Large population, bridges	5.1
d. Large DEPENDENT population	9.0

Analysis:

The participants contributed the above calibrations to the subfactor scales for the national model. For each subfactor above there is a low (Port Heaven) and a high (Port Hell) severity limit, which are assigned values of 1 and 9 respectively. The participants determined numerical values for two intermediate qualitative descriptions between those two extreme limits. In general, participants from this port evaluated the difference in risk between the lower limit (Port Heaven) and the first intermediate scale point as being equal to the difference in risk associated with the first and second intermediate scale points. The difference in risk between the second intermediate scale point and the upper risk limit (Port Hell) was generally twice as great.

Book 4 *Risk Subfactor Ratings (Corpus Christi)*

Fleet Composition	**Traffic Conditions**	**Navigational Conditions**	**Waterway Configuration**	**Short-term Consequences**	**Long-term Consequences**
% High Risk Deep Draft	Volume Deep Draft	Wind Conditions	Visibility Obstructions	Volume of Passengers	Economic Impacts
4.1	3.4	2.6	3.8	3.7	7.1
% High Risk Shallow Draft	Volume Shallow Draft	Visibility Conditions	Passing Arrangements	Volume of Petroleum	Environmental Impacts
4.6	4.7	2.0	3.9	7.5	6.0
	Vol. Fishing & Pleasure Craft	Currents, Tides, Rivers	Channel and Bottom	Volume of Chemicals	Health & Safety Impacts
	5.8	5.5	3.6	4.7	4.6
	Traffic Density	Ice Conditions	Waterway Complexity		
	4.9	1.0	7.5		

Analysis:

The participants determined that the following subfactors contributed the most to risk in the port of Corpus Christi:

- The fact that a high volume of petroleum products moves through the waterway increases the risk of the waterway.
- The waterway is very complex, creating a high risk
- Given a casualty in the waterway, there is a high risk to affecting the economy of the area
- Given the environmental sensitivity of the area, a casualty would cause great damage.
- The volume nf fishing and pleasure is a leading concern for risk of a casualty in the port.

Book 5 *(Corpus Christi)*

	Risk Factors						
	Fleet Composition	**Traffic Conditions**	**Navigational Conditions**	**Waterway Configuration**	**Short-term Consequences**	**Long-term Consequences**	**Relative Merit Index**
VTS	13.9	8.6	8.4	11.1	14.1	17.0	**12.1**
VTIS	19.1	20.3	24.7	16.1	25.5	22.3	**23.6**
EAIS	29.4	30.5	31.2	31.4	27.1	22.7	**28.7**
AIS	21.0	19.5	17.1	16.7	16.5	16.2	**17.4**
Improve Current System	16.6	21.2	18.6	14.8	16.8	21.9	**18.2**

Analysis:

This table shows that the participants believe that the tool of EAIS will contribute the greatest potential for risk mitigation given the factors that drive risk in the port of Corpus Christi. This is followed closely by VTIS.

Risk Factors	Risks	Mitigations
Fleet Composition		
% High Risk Deep Draft Cargo & Passenger Vessels	Most are Port State Control Priorities III & IV	Deep draft concerns are adequately addressed.
	Mix is approximately 2/3 Foreign Flag, 1/3 U.S. Flag	Enforcement of STCW requirements w/ regards to language barriers
	The most common casualty is loss of power, with the most common resulting consequence being channel blockage	
	Deep draft vessels are constrained to dredged channels	
%High Risk Shallow Draft Cargo & Passenger Vessels	Vessels in this category are U.S.-Flag	
	A significant percentage of the problems with this class of vessel stems from lack of familiarity with and/or experience in the waterway	Make better information available, provide real-time access to current and tidal sensors
	Tugs with too little horsepower for size of tows can encounter problems maneuvering or during high winds	Improve operating practices. Continue permit practice for oversize tows
	The small number of lay berths at which to wait out adverse weather contributes to risk, causing voyages to be continued when conditions should be waited out	

Risk Factors	Risks	Mitigations
Traffic Conditions		
Volume of Deep Draft Vessels	1. Deep Draft vessels represent about 20% of all commercial cargo traffic, with approximately 10 arrivals daily 2. 23 Navy vsls running out of the Naval Base (medium to large) vsls • 40 transits per week	
Volume of Shallow Draft Vessels	1. Shallow draft vessels represent about 80% of area's commercial cargo traffic 2. Approximately 80% of these come through Aransas Bay 3. OSVs are running out of Rockport 4. Tows leaving Port of Corpus Christi area often cut across Bay to Southeast	
Volume of Fishing & Pleasure Craft	1. A large number use the area, with many trailered boats from out of area. Operators of these are unfamiliar with both the area and Rules of the Road 2. The concentration of pleasure and fishing craft differs from location to location	Enforcement of existing regulations and education. Increase enforcement presence on waterways.
Traffic Density	1. There tends to be a concentration of pleasure and fishing craft near Port Aransas and the jetties. Movements tend to be unpredictable and most pleasure craft do not follow the Rules of the Road 2. Shrimpers tend to fish between markers 13 to 38, which can cause concerns for tugs/barges	Enforcement of existing regulations and education; increase enforcement presence on waterways

Risk Factors	Risks	Mitigations
	3. JFK bridge is a bad area…very dense concentration of fishing vessels and pleasure craft…no deep draft but have seasonal shallow water traffic 4. Pleasure craft tend to concentrate around harbor bridge, with fishing vessels mixed in 5. Many fishing vessels move in and out of Aransas Pass	
Navigational Conditions		
Wind Conditions	1. Prevailing winds are from SE 2. Average wind velocity is 20 kts, but exceeds 30 knots as much as 30% percent of time 3. During high winds tows have problem staying in channel; crabbing increases virtual width of tows, which creates problems for other traffic and ATON 4. Squall line and frontal passage results in unpredicted/unanticipated high winds. Conditions apply year round. 5. When wind blows against current, steep swells are created which can cause problems for tows. This is particularly the case in the Port Aransas area. 6. Transits of Bay during high winds can give rise to problems for lightly loaded barges	COTP orders can be issued to restrict movement. Don't transit during high winds
Visibility Conditions	1. January and February are worst months for fog. 2. Thunderstorms and squall line passage with accompanying rain can obscure visibility.	

Risk Factors	Risks	Mitigations
	accompanying rain can obscure visibility. 3. Background lighting obscures aids to navigation and vessel lights during night approach to Corpus Christi and navigating the La Quinta Channel	
Currents, Tides and Rivers	The Port Aransas area is subject to strong and often unpredictable tidal currents	More tide and current meters are required to augment the Corpus Christi real-time navigation system.
Ice	Corpus Christi never encounters icing conditions that affect navigation	
Waterway Configuration		
Visibility Obstructions	1. Condominiums in the Port Aransas area obscure visibility 2. Blind corners: • Outbound in vicinity of rigs at Ingleside • Outbound inner harbor vicinity of bridge • Inbound Port Aransas Pass vicinity of Liddy Ann Channel (blocked by dunes) 3. Some ranges are blocked by new construction or moored vessels 4. Range is off-center coming into the harbor; local knowledge is required.	Utilize AIS coupled with electronic charting Advertise better or reposition the range
Passing Arrangements	Meetings of wide tows can be a problem in some locations.	1. Adverse meetings involving deep draft ships are avoided through practices adopted by pilots and use of information available from Harbormaster 2. Problems are partially addressed through over-sized tow permit program
Channel and Bottom	1. In general, bottom is sand and mud, represents no problem	

Risk Factors	Risks	Mitigations
	2. There are rocks between Markers 9 and 13 which reduce channel depth to 7 ft. 3. Well head or broken pipeline exposed in the middle of Corpus Christi Bay	Establish ATON to mark the cross bay channel
Waterway Complexity	1. Bay is wide open and no problem 2. Aransas Pass is area of complexity: • Junction of 4 converging waterways • Crossing traffic 3. Junction of La Quinta Channel with main ship channel: 4. Merging traffic 5. ICW crossing main ship channel	Movement of Large rigs requires closure of waterway
Short Term Consequences		
Number of People on Waterway	1. High concentrations of people on the waterway near Port Aransas, JFK Bridge and La Quinta Channel 2. Future may bring cruise ship(s) into inner harbor 3. Ferries operating in Port Aransas area	
Volume of Petroleum Cargoes	1. About 80 million barrels of oil per year move through area 2. Worst case spill is one occurring at Port Aransas as the result of a collision between deep- and shallow-draft tank vessels on a flood tide	1. Most petroleum facilities and moored tank vessels are in Inner Harbor where spills, if they occur, can easily be contained 2. Double hulls combined with soft bottom minimize potential for spills incident to groundings. Good communications between vessels reduces likelihood of collisions

Risk Factors	Risks	Mitigations
Volume of Hazardous Chemical Cargoes	1. Chemical carriers represent five percent of tonnage calling in area 2. Populated areas could be exposed to noxious chemical plumes, given prevailing winds 3. There are infrequent movements of ammunition ships and LHG carriers	Use moving Safety Zone
Long-Term Consequences		
Economic Impacts	1. Channel blockage will begin to affect area within 12 hours to 5 days, depending upon where blockage occurs 2. Spills can impact fishing industry and tourism 3. Inner harbor spill can require closure of cooling water intakes	
Environmental Impacts	1. Worst problem is major oil spill in the bay 2. Hazardous chemicals could enter water column, resulting in significant long-term impact upon fisheries 3. The area has significant wetlands, environmentally sensitive areas	
Health and Safety Impacts	Populated areas could be exposed to noxious chemical plumes, given prevailing winds	